

Design and applications of the **S18-USANS-Instrument** at ILL

**M. Baron, G. Badurek, M. Hainbuchner, E. Jericha,
R. Loidl, M. Trinker, M. Villa and H. Rauch**

Outline

- History
- the S18
 - Setup of the instrument
 - Sample environment
 - Control system
- Recent experiments
- Publications

History

ATI, Vienna

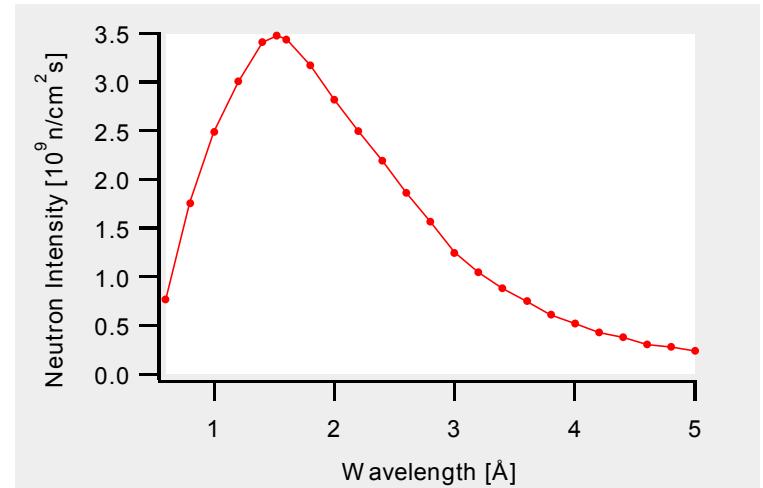
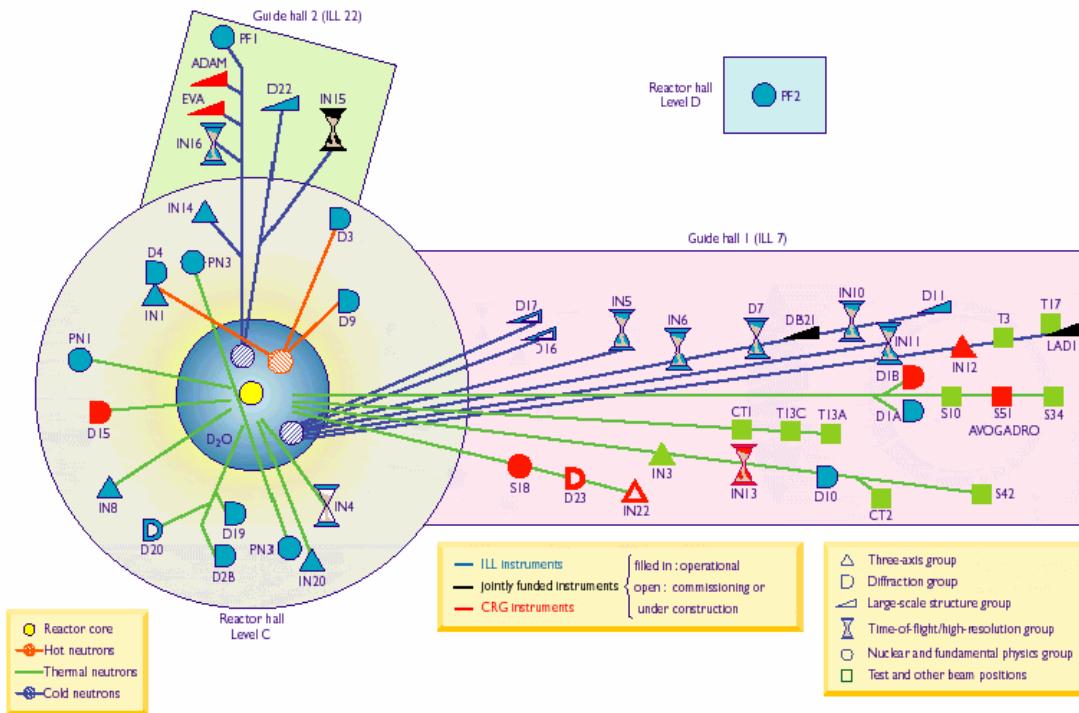
- | | |
|------|--|
| 1977 | First Bonse-Hart Camera |
| | D. Bader, Master-Thesis (1978) |
| 1991 | New crystals (331),
→ higher Flux ($10 \text{ n/cm}^2\text{s}$) |
| | G. Zugarek, PhD-Thesis (1991) |
| 1998 | Adapted to tail suppression |
| | M. Agamalian, M. Wignall & R. Triolo |
| | J. Appl. Cryst. 30 (1997) 345 |

ILL, Grenoble

- | | |
|------|--|
| 1974 | Invitation of the director
H. Maier-Leibnitz |
| 1975 | Prototype of the D18 |
| 1982 | D18 → S18 |
| 1998 | First USANS-measurements
G. Kroupa et al., Nucl. Instr. Meth.
A 440 (2000) 604 |

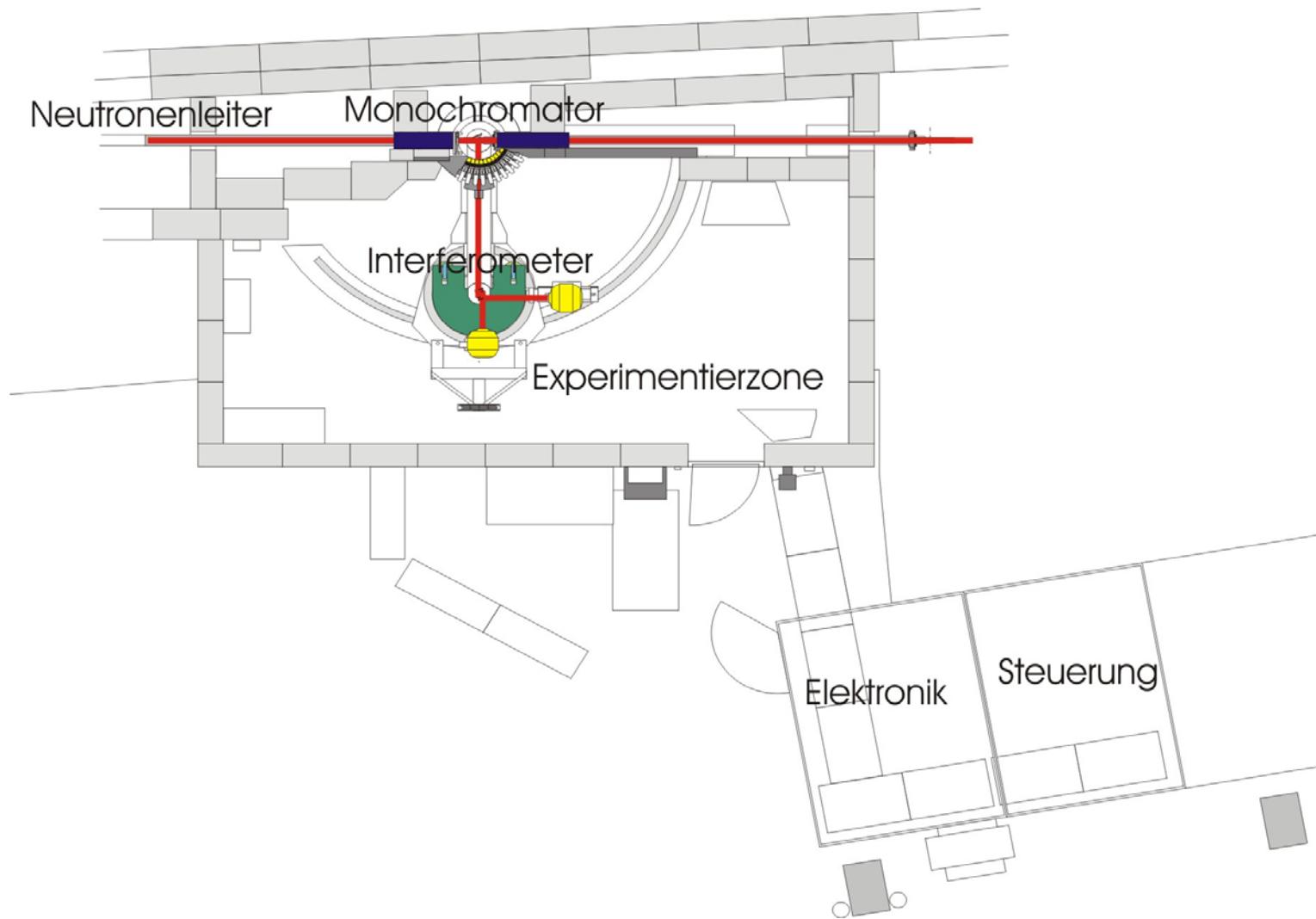
Super-mirror beam guide

Flux at the H25



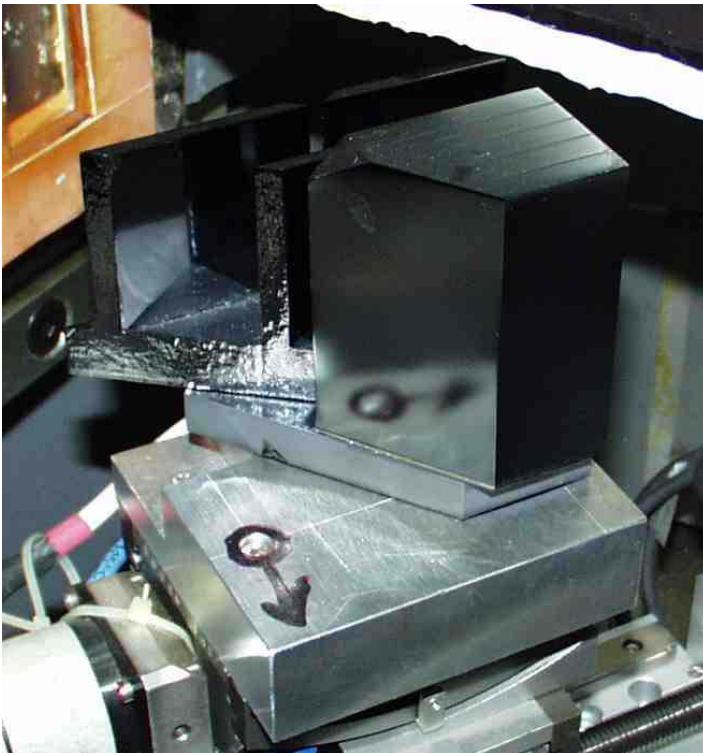


- Vibration isolation
- Sample support
- 2 movable He-3 detectors
- Movable optical bench
- Possibility of 3rd axis
- PSD (DEI)



1.Axis:

- Monochromator



Reflecting planes:

[111],[220],[113],[115],[117],[331],[335],[551],[400]

Wavelength range: $0.6 \text{ \AA} < \lambda < 5 \text{ \AA}$

Bragg angle range: $20^\circ < \theta_B < 55^\circ$

Type: silicon channel-cut perfect crystal

Reflecting planes: [220]

Wavelength range: $1.6 \text{ \AA} < \lambda < 2.9 \text{ \AA}$

Bragg angle range: $25^\circ < \theta_B < 50^\circ$

beam area: $2 \times 4 \text{ cm}^2$

2.Axis

- USANS



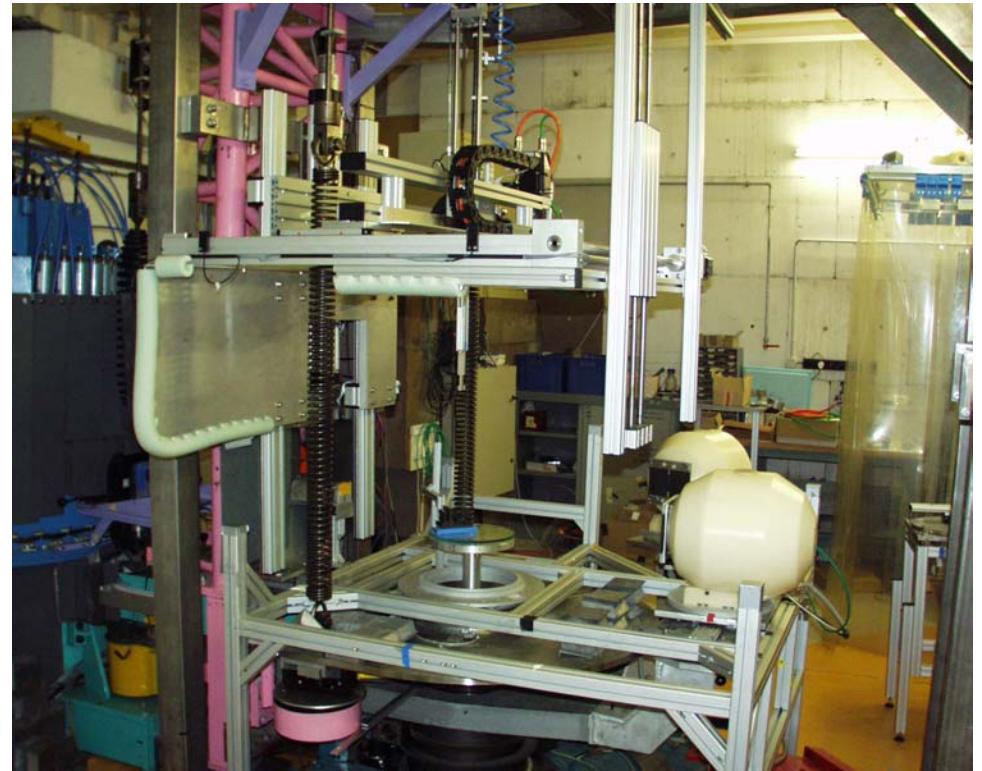
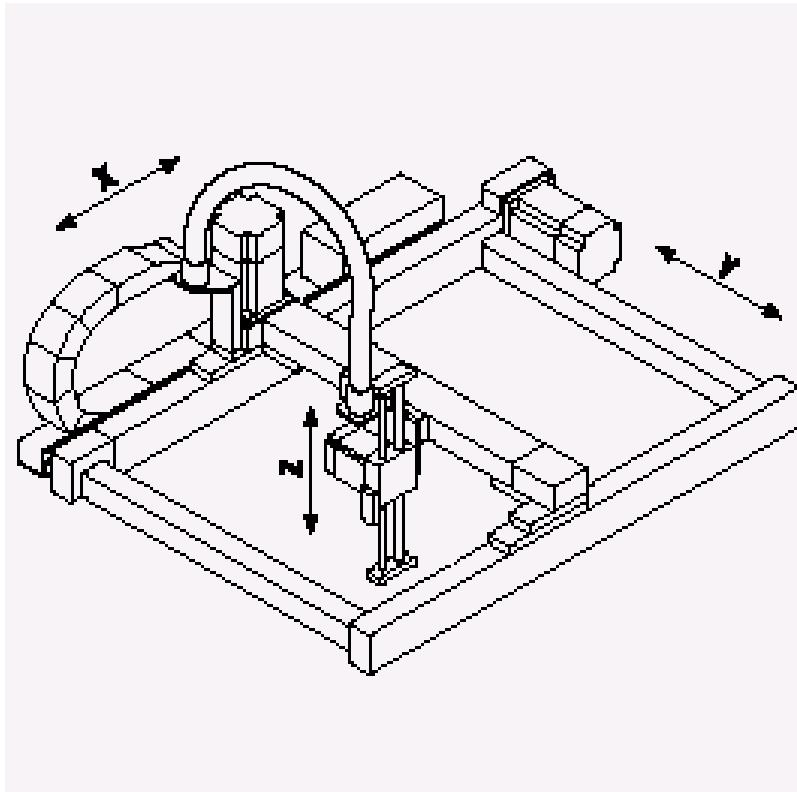
Ultra small-angle scattering

Bonse-Hart camera with two channel-cut perfect crystals
Bonse U., Hart M. (1965), *Appl. Phys. Lett.* 7, 238-240

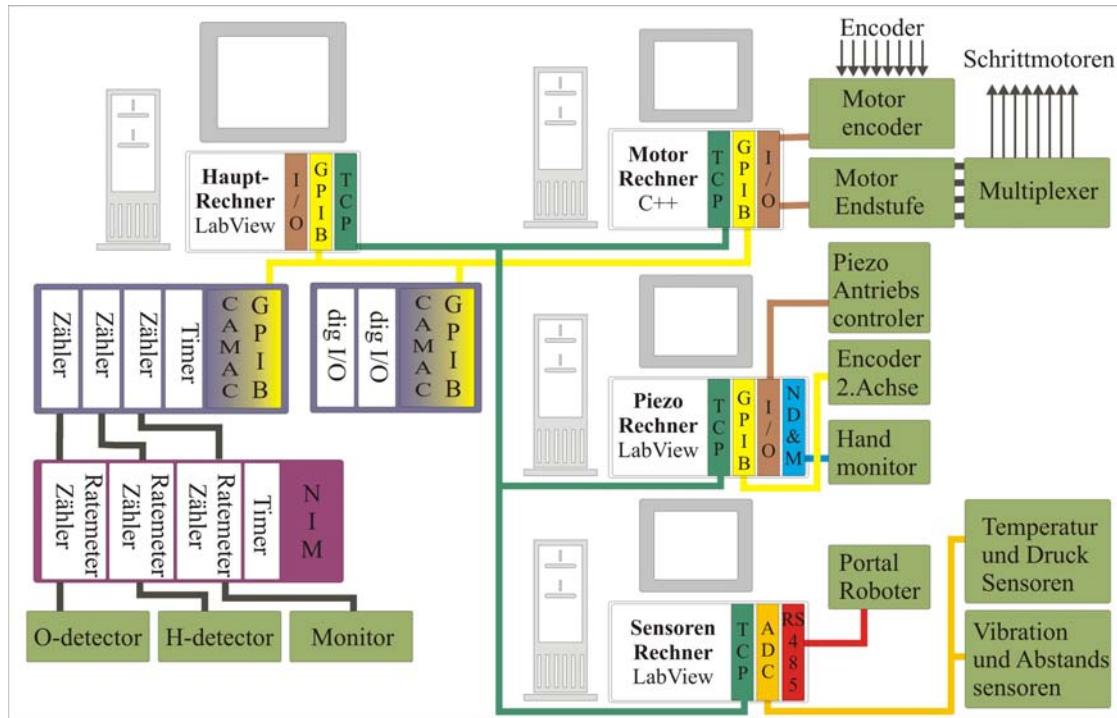
type	6-fold [220] Bragg reflection
peak intensity	$6000 \text{ n cm}^{-2} \text{ s}^{-1}$
angular resolution	0.01" (0.036" with absolute encoder)

momentum transfer range $2 \cdot 10^{-5} - 10^{-2} \text{ \AA}^{-1}$
background $2 \cdot 10^{-6}$

New portal robot



Control system



Control software:
LabView

Standard methods

Experimental:

- The scattering pattern is recorded on a logarithmic equidistant q-scale
- Counting: on time base in low q-region
on counts in high q-region
- a D11 calibrated Standard is measured as reference with each sample series
- Temperature, humidity and pressure sensors

Data treatment using Igorpro-scripts:

- according to the Oakridge USANS data treatment user manual
(with some modifications)
- Desmearing:
 - Schmidt procedures (standard used)
Schmidt P.W., Hight R., Acta Cryst., 13 (1960) 480
Schmidt P.W., Acta Cryst., 19 (1965) 938
 - Lake procedures
Lake J.A., Acta Cryst., 23 (1967) 191
- Model fitting based on NIST Igorpro scripts

CRG-C Experiment

(Collaborating Research Groups)

Responsibles: **Helmut Rauch**
 Gerald Badurek

Local Contacts: **Rudolf Loidl**
 Matthias Baron

Users of the S18

O. Glatter

Karl-Franzens University, Physical Chemistry, Graz, Austria

S. Mazumder

Bhabha Atomic Research Center, Mumbai, India

A. Radlinski

Australian Geological Survey Organisation, Canberra City, Australia

T. M. Sabine

University of Technology, Sydney, Australia

J. Saroun

Nuclear Physik Institut, Rez, Czech Republic

R. Triolo

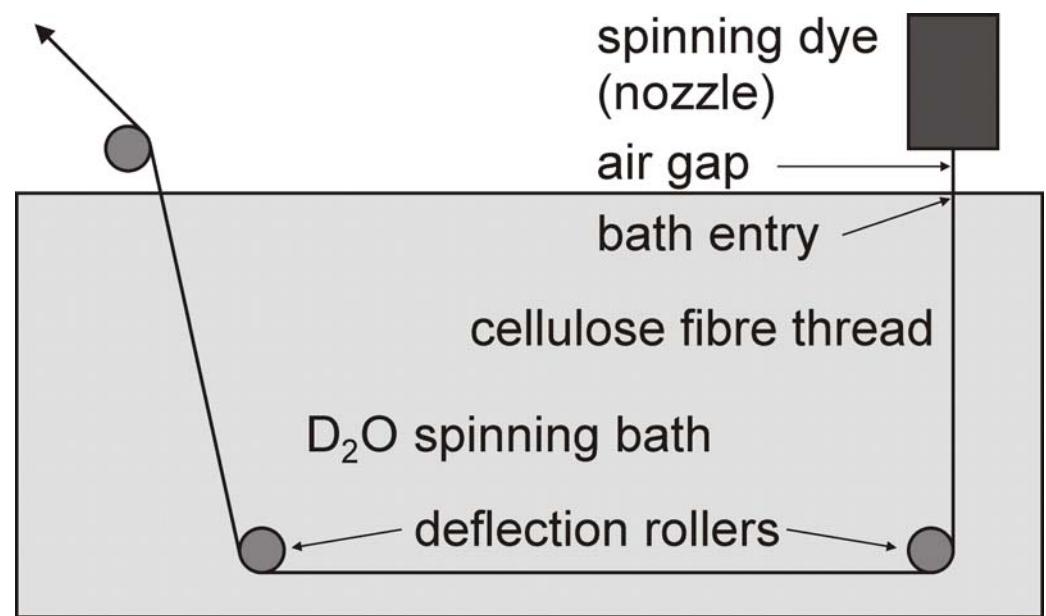
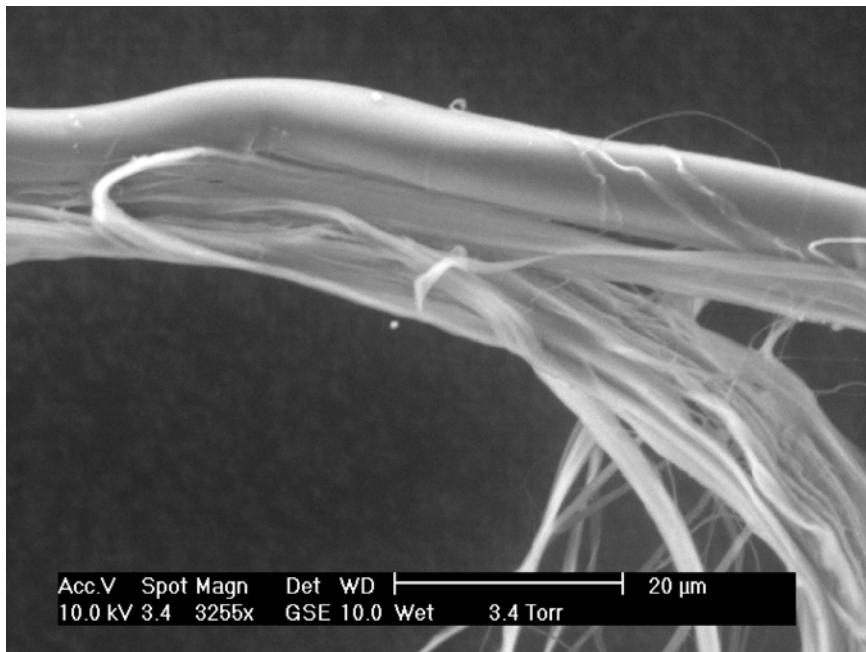
University of Palermo, Italy

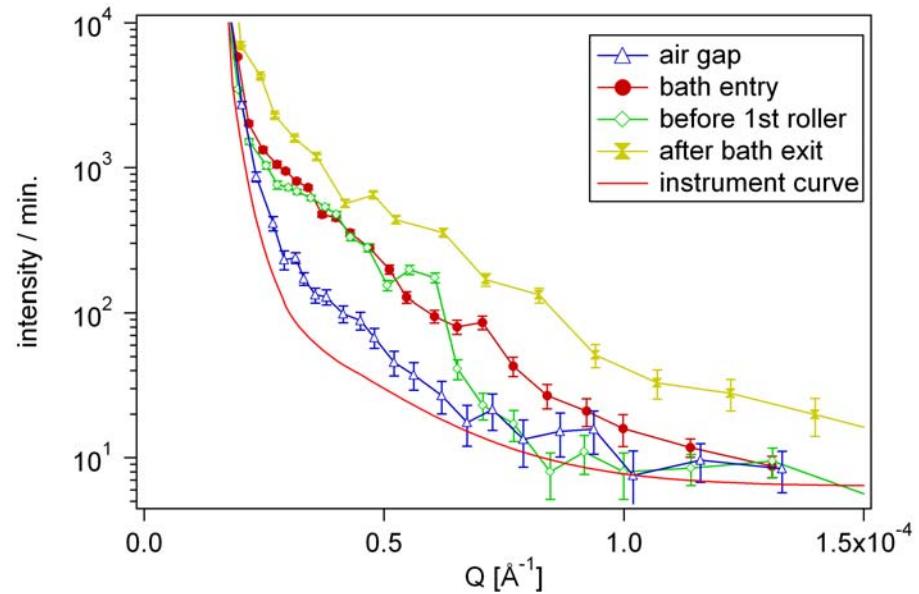
L. Vance

Australian Nuclear Science and Technology Organisation, Australia

Lenzing AG

E. Jericha, M. Schuster



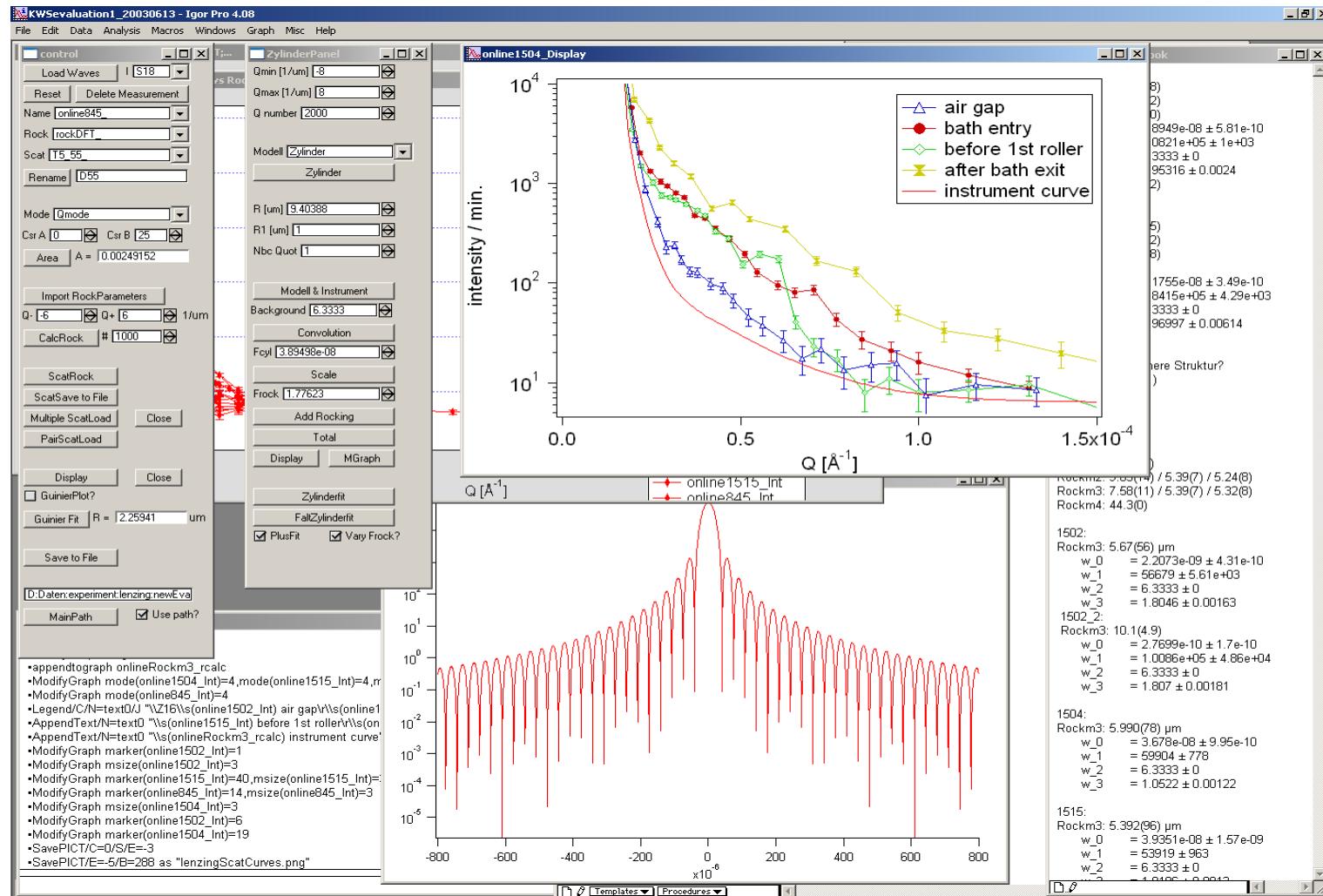


Structure investigations of lyocell fibres by in-situ USANS measurements

E. Jericha, M. Villa, M. Baron, R. Loidl, O. Biganska, P. Navard, S. Patlazhan,

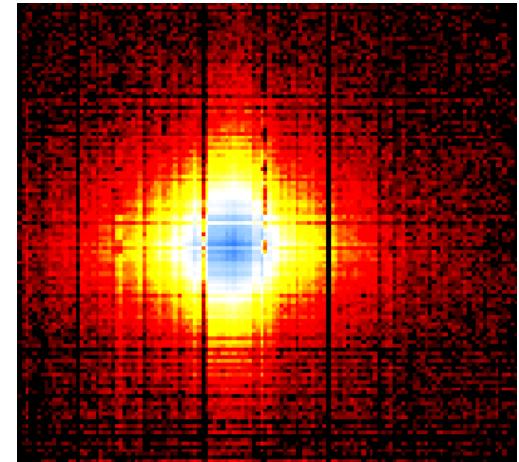
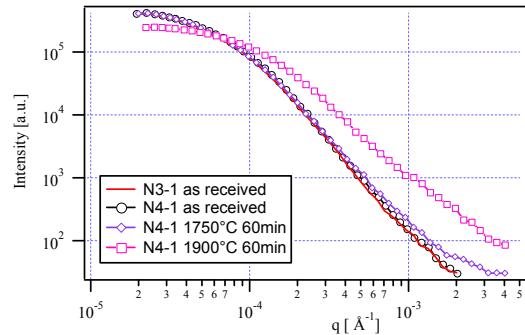
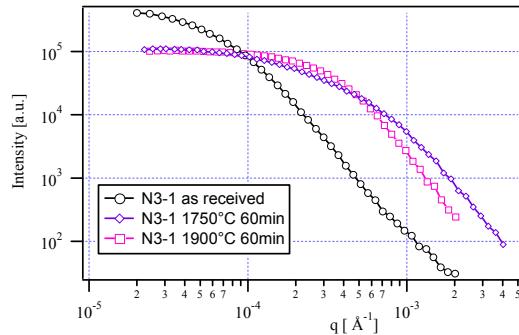
P. Alfred, H. Rüf and K.C. Schuster

3rd ECNS, September 3 - 6, (2003), Montpellier, France



SiC/SiC_f

M. Hainbuchner

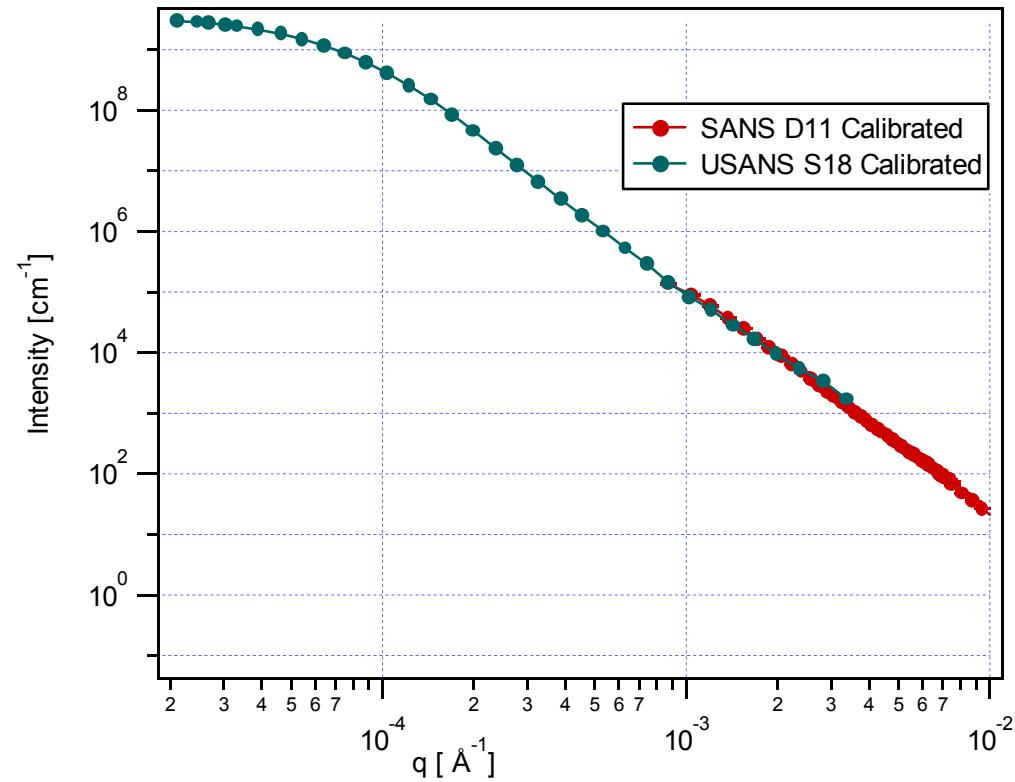


Results of small and ultra small angle neutron scattering investigations on SiC/SiCf ceramic composite materials

M. Hainbuchner, M. Villa, M. Baron, J.Kohlbrecher and H. Rauch

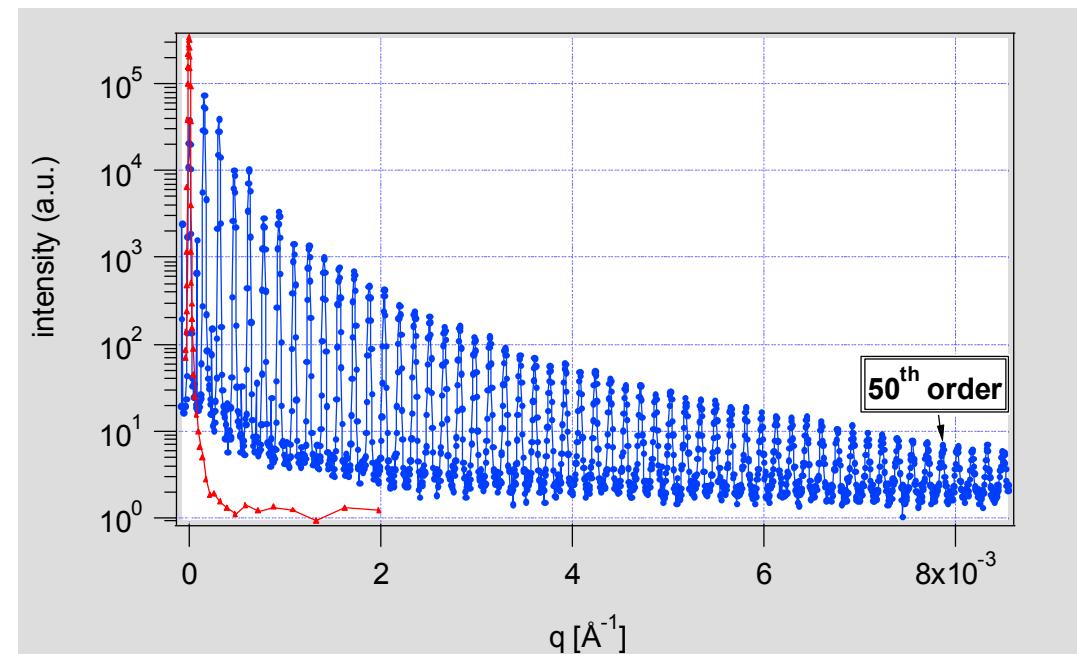
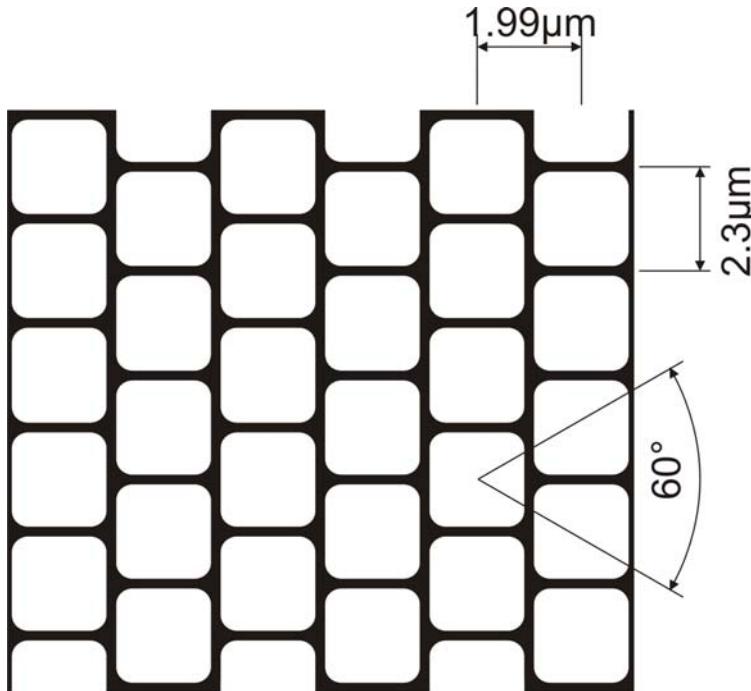
SiCf/SiC Ceramic composites for fusion application, October 12-13, 2000, Frascati, Italy 237 (2001)

SiC calibration sample



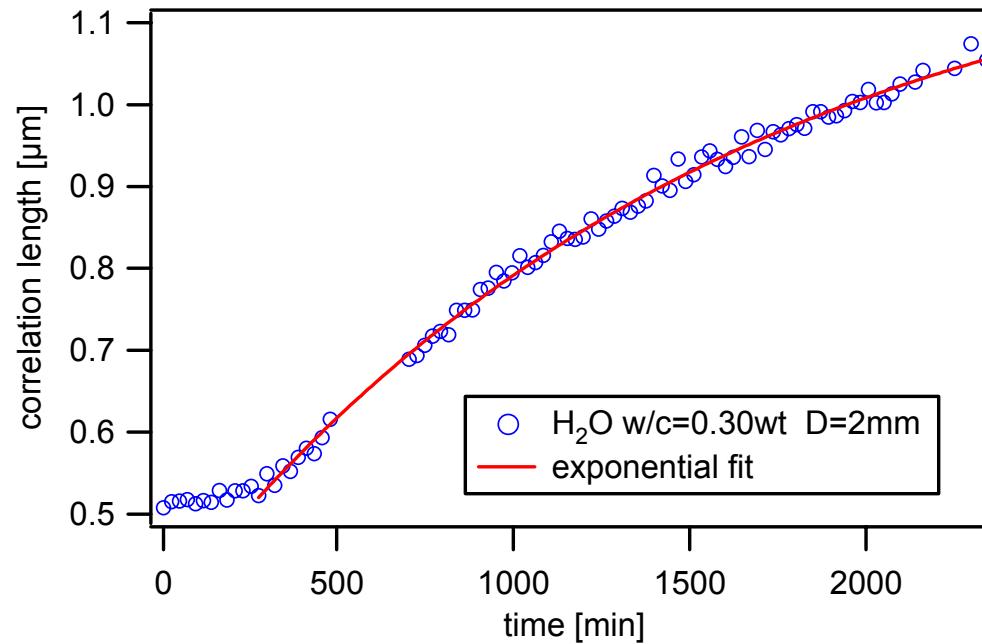
Artificial Silicon lattice

M. Hainbuchner, E. Jericha, R. Loidl, M. Villa



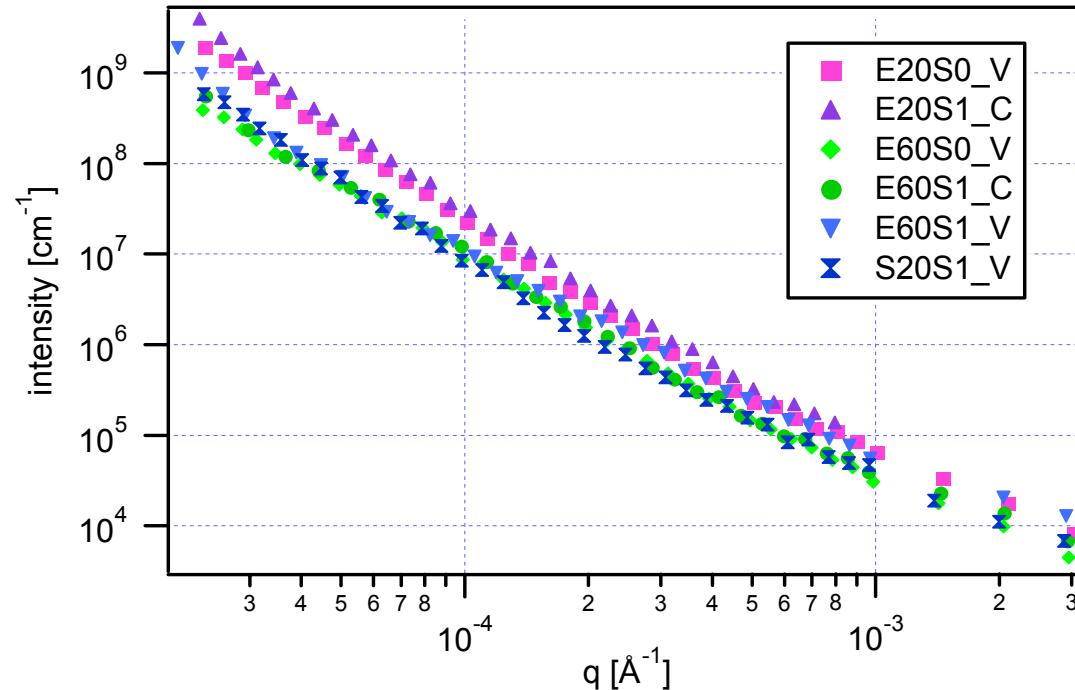
Time dependence of the correlation length during hydration of a Portland cement paste

S. Mazumder



Pirelli

R. Triolo



Structural investigation of hybrid nanocomposites

Lo Celso, F., Triolo, A., Negroni, F., Hainbuchner, M., Baron, M., Strunz, P.,
Rauch, H., Triolo R.

Appl. Phys. A 74 (2002) S1430-S1432

ATOMINSTITUT DER ÖSTERREICHISCHEN UNIVERSITÄTEN

2003-07-09

INSTITUT MAX VON LAUE - PAUL LANGEVIN

MATTHIAS BARON

Pore size distribution in offshore oil wells

A. Radlinski

Figure 2A

Oil Well 1

SANS and USANS pore size distribution
part 1: 2450 m to 3050 m

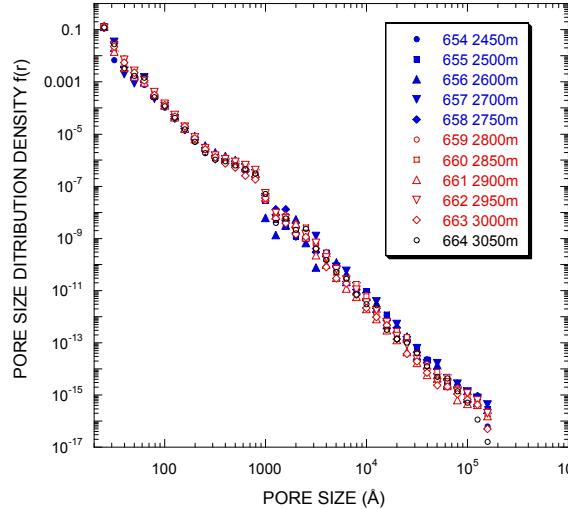
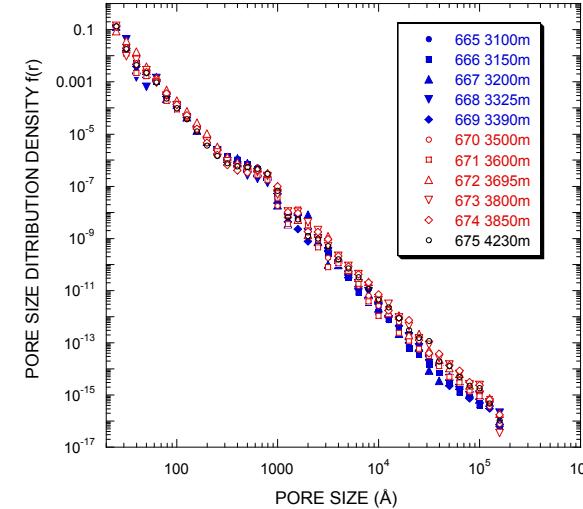


Figure 2B

Oil Well 1

SANS and USANS pore size distribution
part 2: 3100 m to 4230 m



Publications

Structure investigations of lyocell fibres by in-situ USANS measurements

E. Jericha, M. Villa, M. Baron, R. Loidl, O. Biganska, P. Navard, S. Patlazhan, P. Alfred, H. Rüf and K.C. Schuster

3rd ECNS, September 3 - 6, (2003), Montpellier, France

Optimisation of a Crystal Design for a Bonse-Hart Camera

M. Villa, M. Baron, M. Hainbuchner, E. Jericha, V. Leiner, D. Schwahn, E. Seidl, J. Stahn, H. Rauch

J. Appl. Cryst., 769 (2003)

USANS Studies of Artificial Lattices

E. Jericha, M. Baron, M. Hainbuchner, R. Loidl, M. Villa, H. Rauch

J. Appl. Cryst., 778 (2003)

Scattering studies of large scale structures at the ultra small angle neutron scattering instrument S18

Hainbuchner, M., Baron, M., Lo Celso, F., Triolo, A., Triolo, R., and Rauch, H.
Physica A 304 (2002) 220-229

Structural investigation of hybrid nanocomposites

Lo Celso, F., Triolo, A., Negroni, F., Hainbuchner, M., Baron, M., Strunz, P., Rauch, H., Triolo R.

Appl. Phys. A 74 (2002) S1430-S1432

Non-Invasive Measurements of Pore Size Distribution in Coal Pellets Using X-Ray and Neutron Techniques

P. Radlinski, P., Mastalerz, M., Hinde, A. L., Hainbuchner, M., Rauch, H., Baron, M., Lin, J. S., Fan, L., and Thiagarajan P.

2001 International Coalbed Methane Symposium, Tuscaloosa, AL, May 14-17, 2001

Manifestation of the statistical nature of a medium in multiple small-angle scattering

Mazumder, S., Sen, D., Roy, S.K., Hainbuchner, M., Baron, M., Rauch, H.

J. Phys. Cond. Matter 13 (2000) 5089

The new high resolution ultra small angle neutron scattering instrument at the high flux reactor in Grenoble

M. Hainbuchner, M. Villa, G. Kroupa, G. Bruckner, M. Baron, H. Amenitsch, E. Seidl, H. Rauch; J. Appl. Cryst. 33, 851 (2000)